T.E.

VELOCITY SIGNAL NET WORKS

VN-330

MP MASTER
MA34249

LTV
LING-TEMCO-VOUGHT, INC.

LING
ELECTRONICS DIVISION

INSTRUCTION MANUAL

VELOCITY SIGNAL NETWORKS

IN ALL CORRESPONDENCE WITH THE FACTORY BE SURE TO INCLUDE THE FOLLOWING INFORMATION:

EQUIPMENT MODEL NUMBER

SERIAL NO. 13

LING NO. 42521

LING ELECTRONICS Division
LING-TEMCO-VOUGHT, INC.
1515 So. Manchester Avenue
Anaheim, California

VSN-114-3

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SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION

The Ling Electronics Velocity Signal Networks are designed to measure shaker armature velocity. The network consists of a resistor-inductor circuit and a step-up isolation transformer. Networks are designed specifically for operation with certain shakers as shown in table 1-1.

TABLE 1-1 VELOCITY SIGNAL NETWORKS

NETWORK MODEL	to be used with	SHAKER MODEL
VN175		B290/A175
VNL200		L200
VN219		219
VN219L		219L
VN227	(A280 shaker serial number 11 through 54)	227, 227L
VN245		A245/A295
VNA246		A246
VN249		249, A249
VN275		275
VNA280	(shaker serial number 55 and up)	A280
VNB280		B280
VNA285	(shaker serial number 67 and up)	A285
VNB285	(shaker serial number 11 through 66)	B285
VNB285A	(shaker serial number 67 and up)	B285
VN300	(shaker serial number 11 through 50)	300, A300, B300
VN300A	(shaker serial number 51 and up)	300, A300, B300
VN310	(Thruster serialnumber 11 through 18)	310 (Thruster)
VN310A	(Thruster serial number 18 and up)	310 (Thruster)
VN330		330

1-2. PURPOSE

The purpose of the velocity signal network is to provide a velocity signal which may be integrated and used for displacement control.

1-3. SPECIFICATIONS

a. All velocity signal network specifications are as follows:

(1). Output sensitivity 68.1 mv/rms/inch peak/second

(2). Calibration (5cps to 200 cps) ±3percent

(3). Output impedance (maximum) 5000 ohms

SECTION 2
INSTALLATION

2-1. UNPACKING AND HANDLING

a. Commercial packaging methods are followed in preparing the network for shipment. Normal precautions should be taken in the unpacking and handling of the equipment.

b. Carefully inspect the equipment after unpacking. Notify the shipping agent immediately of any damage suffered in transit.

2-2. INSTALLATION

a. The velocity signal network is normally mounted in the amplifier or console. If it is to be mounted externally, a well ventilated location to facilitate convection cooling should be selected.

b. Each network is designed for use with a particular length of armature cable. Cable lengths for each unit are shown in table 2-1.

TABLE 2-1 VELOCITY SIGNAL NETWORK CABLE LENGTHS (IN FEET)

NETWORK MODEL	MINIMUM LENGTH	MAXIMUM LENGTH
VN175	6	34
VNL200	0	60
VN219	6	34
VN219L	6	34
VN227	16	24
VN245	20	32
VNA246	22	42
VN249	15	55
VN275	22.5	44.5
VNA280	16	34
VNB280	16	34
VNA285	6	34
VNB285 & VNB285A	6	34
VA300 & VN300A	23.5	45.5
VA310 & VN310A	23.5	45.5
VN330	23.5	45.5

c. Use of cable lengths other than those shown in table 2-1 will result in sensitivity error in the velocity signal network. For optional lengths, a special calibration or network is required.

SECTION 3
PRINCIPLES OF OPERATION

3-1. CIRCUIT DESCRIPTION (refer to the schematic drawing)

a. Shaker armature voltage normally consists of two components; voltage drop due to the blocked armature impedance, and the velocity induced voltage (back electromotive force).

b. The velocity signal network corrects the armature voltage by electrically subtracting the blocked armature impedance component; this leaves the output signal proportional to armature coil velocity. This output signal may then be used to control displacement by means of a servo loop.

c. The network is designed and calibrated for use with the applicable shaker operated at rated field current. Operation at other than rated field current will result in sensitivity error.

SECTION 4
MAINTENANCE

4-1. TOOLS AND EQUIPMENT

a. The following is a list of tools and equipment required to perform the functions outlined in this manual:

(1). One Hewlett Packard Model 400A Vacuum Tube Voltmeter or equivalent.

(2). One 4 inch slot screwdriver.

(3). One 4 inch crescent wrench.

(4). Four pieces of steel or aluminum bar stock cut and drilled to flexure size or, one piece of steel or aluminum bar stock cut and fitted to anti-gravity spring size.

4-2. UNIT FAILURE

a. The velocity signal network is basically trouble free and normally requires no maintenance. If the unit fails in the field, it is preferable to return the entire network so the repair and recalibration may be performed at the factory. The corrective action taken depends upon the nature of failure and the type of installation. Should a component or unit malfunction, use the following procedure:

(1). If coil L1 and/or L2 have failed, they must both be returned to the factory. These coils operate as a pair and must be checked together.

(2). Repairs to other network components can be made in the field. The necessary recalibration of the network, after repairs, may be done by following special instructions which are available upon request.

4-3. SENSITIVITY ADJUSTMENT

a. Accuracy of the network may be improved for measurement of the armature relative velocity when operating with heavy loads and low velocity. The following procedure will calibrate the unit for high force, low velocity operation:

(1). Block the armature by rigid attachment of armature to the shaker body. A solid block in place of the flexures or anti-gravity spring or another suitable clamping device may be used. The first resonance of the blocked armature system should be above 800 cps.

(2). With the shaker field operating at rated field current, apply armature current at the operating frequency. Any convenient level may be used, provided it is not too low.

(3). Break the seal and adjust R1 for a null at the velocity signal output terminals (1 and 2). A sensitive VTVM should be used for this measurement since the voltage is approaching zero.

NOTE

IF PREFERRED, THE NETWORK MAY BE RETURNED TO THE FACTORY FOR RECALIBRATION; HOWEVER, IF THE SEAL ON RESISTOR R1 HAS BEEN BROKEN, A CHARGE WILL BE MADE FOR THE SERVICE.

(4). Lock R1 and unblock the armature.

(5). With the shaker operating at a known velocity, adjust R3 of the network for correct sensitivity.

(6). Check the response of the system.

b. Calibration of the network in this manner ensures maximum accuracy at this and the immediate frequencies. At other frequencies, the error is dependent on the shaker load.

4-4. CLEANING

The only cleaning necessary is to keep the chassis free of dust. To clean, use low pressure air, a vacuum cleaner, or a soft brush.

4-5. OTHER DIFFICULTY

In the event of troubles or problems not covered by this manual, contact the factory, giving serial number, Ling number, conditions of use, and a full description of the problem. Ling field engineering personnel are available for consultation on special problems concerning the utilization or application of Ling equipment.

ENGINEERING PARTS LIST

DATE 12-15-65 PAGE 1 MANUAL

REV. CONT'D ON 2 REQUISITION NO.

MODEL OR ASSY.	SERIAL NO.	SHOP ORDER	PON	QTY.	ACCOUNT NO.	M-DAY	DATE
VN 330	11 & up	3580, & up	42521				

ITEM NO.	*R.S.	SYMBOL DESIG.	STOCK/DWG NUMBER	DESCRIPTION	MFG CODE	MANUFACTURER PART NUMBER	QTY. ASSY.	QTY. UNIT	CODE	KARDEX	PURCHASE ORDER
			21776	Schematic			-	-			
			B110476	Loom Wiring			-	-			
			43272	Main Wiring Assy			-	-			
			A110457	Marker Strip Engraving			-	-			

*R.S. - RECOMMENDED AS CUSTOMER SPARES

DEPARTMENT	ISSUED BY	ISSUE DATE	R

LING ELECTRONICS A division of LING-TEMCO-VOUGHT, INC.

ENGINEERING PARTS LIST

DATE 11 Feb 64 PAGE 2 MANUAL

REV. CONT'D ON 3 REQUISITION NO.

MODEL OR ASSY.	SERIAL NO.	SHOP ORDER	PON	QTY.	ACCOUNT NO.	M DAY	DATE
VN 330							

REV.	ITEM NO.	*R.S.	SYMBOL DESIG.	STOCK/DWG NUMBER	DESCRIPTION	MFR. CODE	MANUFACTURER PART NUMBER	QTY. ASSY.	QTY. UNIT	OPT	KARDEX	PURCHASE ORDER
				43273	Instl. & Assy Consisting of the Following			(1)	(1)			
			43273-1	C110503	Coil & Lug Assy			1	1			
			43273-2	43272	Main Wiring Assy			1	1			
			43273-3		Lug	DOSSERT	H2LA-21-1-90 (D2441)	1	1			
			43273-4		Lug	DOSSERT	H2L2-21-2-90 (D2438)	1	1			
			43273-5		Lug	DOSSERT	H2LA-21-2N-90	1	1			
			43273-6	21254	Name Plate			1	1			

*R.S. - RECOMMENDED AS CUSTOMER SPARES

DEPARTMENT | ISSUED BY | ISSUE DATE

ENGINEERING PARTS LIST

DATE 10-9-63 PAGE 3 MANUAL
REV. CONT'D ON 4 REQUISITION NO.

MODEL OR ASSY.	SERIAL NO.	SHOP ORDER	PON	QTY.	ACCOUNT NO.	M-DAY	DATE
VN 330							

REV.	ITEM	*R.S.	SYMBOL DESIG.	STOCK/DWG NUMBER	DESCRIPTION	MFG CODE	MANUFACTURER PART NUMBER	QTY. ASSY.	QTY. UNIT	CODE	KARDEX	PURCHASE ORDER
				43272	Main Assy Consisting of the Following			(1)	(1)			
			43272-14		Alum. Utility Case with removeable covers 6x6x.051 ~~THK Gray Hammertone~~			1	1			
			43272-15	B110446	Top Cover Rework			1	1			
			43272-16	B110447	Bottom Cover Rework			1	1			
					Also includes the following Electrical Items							
			TB1	80112-0034	Barrier Strip			1	1			
					Marker Strip	CJ	MSX-6-140-Y	1	1			

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DEPARTMENT	ISSUED BY	ISSUE DATE

ENGINEERING PARTS LIST

DATE 10-9-63 PAGE 4 MANUAL
REV. CONT'D ON — REQUISITION NO.

MODEL OR ASSY.	SERIAL NO.	SHOP ORDER	PON	QTY.	ACCOUNT NO.	M-DAY	DATE
VN 330							

ITEM	INCL.	*R.S.	SYMBOL DESIG.	STOCK/DWG NUMBER	DESCRIPTION	MFG CODE	MANUFACTURER PART NUMBER	QTY. ASSY.	QTY. UNIT	CODE	KARDEX	PURCHASE ORDER
			R1	82262-0020K	Potentiometer W/W type 2 ohm 4W			1	1			
			R2	82259-0301H	Resistor Fixed W/W type 300 ohm 50W			1	2			
			R3	82252-0103K	Potentiometer W/W type 10K 2 W			1	1			
			R4	82247-01P5J	Resistor Fixed W/W type 1.5 ohm ½W			1	1			
			R5	82259-0301H	Resistor Fixed W/w type 300 ohm 50W			1	-			
			T1	82305-0007	Transformer Audio Output			1	1			

*R.S. - RECOMMENDED AS CUSTOMER SPARES

DEPARTMENT	ISSUED BY	ISSUE DATE	REV

LING ELECTRONICS A division of LING-TEMCO-VOUGHT, INC

CODE TO MANUFACTURERS

AA	AIR ASSOCIATES
AB	ALLEN BRADLEY
AC	ASTRON CORPORATION
ACDC	ACDC ELECTRONICS
AD	ADVANCE RELAY
AD-YU	AD-YU LABS
ADEL	ADEL
ADMS	ADAMS & WESTLAKE
AH & H	ARROW-HART & HEGEMAN
AI	AIRCRAFT
AIRM	AIR MARINE PRODUCTS
ALB	ALBION
ALL	ALLIS CHAMBERS
AMC	AMSCO
AME	AMPERITE CO.
AMM	AMMON INSTRUMENTS INC.
AMP	AMPHENOL
AMPX	AMPEX
AP	AIR PAX
APH	ALPHA
API	AMERICAN PAMCOR INC.
AQ	AEROQUIP
AR	AEROVOX
ARCO	ARCO ELECTRONICS
ARM	ARMSTRONG CORK CO.
AS	ASSOCIATED SPRING
ASP	ASSEMBLY PRODUCTS
ATLE	ATLEE
AUTO	AUTOMATIC ELECTRIC
BAS	BASSICK
BC	BARBAR COLMAN
BECK	BECKMAN INSTRUMENTS
BEL	BELDEN
BEN	BENDIX
BG	BOSTON GEAR
BI	BIRNBACH
BIRT	BIRTCHER
BO	BODINE
BOU	BOURNS "TRIMPOT"
BOW	BOWERS
BP	BOGEN-PRESTO
BRE	BREEZE "AERO SEAL"
BRY	BRAYANT
BUD	BUD
BUCH	BUCHANAN
BUG	BUGGIE
BUR	BURROUGHS
BUSS	BUSSMAN MFG.
B & K	BRUEL & KJAER
C	CHATHAM
CA	CARLING ELECTRIC
CAL	CALIDYNE
CALC	CALIFORNIA CHASSIS
CAN	CANNON
CCI	CONTINENTAL CARBON, INC.
CD	CORNELL DUBILIER
CH	CHICAGO STANDARD TRANS.
CHD	CROUSE HINDS
CHSH	CHASE-SHAWMUT
CI	CINEMA
CJ	CINCH-JONES
CK	CONROY & KNOWLTON
CL	CLARK CONTROLER CO.
CLAR	CLAROSTAT
CM	COMPUTER MEASUREMENTS
COR	CORNISH
CP	COMMUNICATION PROD.
CRA	CRAMER
CRAF	CRAFTSMAN
CRIT	CRITTENDEN
CRL	CENTRALAB
CRN	CRANE
CT	CHASSIS TRAK
CTS	CH. TELE SUPPLY
CU	CURTIS
CUT	CUTLER HAMMER
D & H	D & H AWNING
DA	DAYTON
DALE	DALE
DECO	DEECO
DEFT	DEECO FELT
DELR	DELRY
DI	DIALITE CORP. (DIALCO)
DICO	DIAMOND MFG. (DICO)
DM	DIAMOND METAL
DRAK	DRAKE - ATWOOD
DUC	DUCOMMON
DUM	DUMOND
DY	DYMEC
ECK	ECKTRONICS
ED	EDCLIFF INST.
EEW	ELECTRO ENG. WORKS
EF	ELECTRO FAB.
EI	EIMAC
EM	ELECTRO-MEASUREMENTS
ELCO	ELCO
ELME	ELMENCO
ELTC	ELECTRAC
EMC	EMCOR
EMEC	EMEC
EMP	EMPCO
ENDV	ENDEVCO
EP	ENGINEERING PROD.
ER	ERIE
ERA	ELECTRONIC RESEARCH ASSOC.
ERC	ELECTRA RESISTOR CORP.
ES	EAGLE SIGNAL
ESCO	ELECTOR-SWITCH CORP.
ESX	ESSEX
EVER	EVEREST
F	FENWAL
FAN	FANSTEEL
FED	FEDERATED
FED-S	FEDERAL SCREW
FEI	FEDERAL ENTERPRISE, INC.
FF	FEDERAL FASTENING
FP	FISHER-PORTER
FR	FRANZ
FU	FULLER
ITT	FEDERAL (IT & T)
G	GRAYBAR
GA	GATES
GAXY	GALAXY
GC	GENERAL CEMENT
GCON	GENERAL CONTROL
GE	GENERAL ELECTRIC
GLA	GEELAR
GL	GLOBAR
GR	GENERAL RADIO
GRHL	GRAYHILL
GRIS	GRIGSBY CO.
GU	GUDEMAN
GV	G. V. CONTROL
HAW	HARTWELL
HAYS	HAYS MFG.
HE	HEINEMANN
HEY	HEYCO
HP	HEWLETT PACKARD
HGR.	H. G. REISING
HL	HELIPOT
HOF	HOFFMAN
HOP	HOPKINS
HS	HARDWARE SPEC.
HU	HUBBEL
HY	HYCOR
HYD	HAYDON
IGNS	INGERSOL RAND
IL	ILSCO
ILG	ILG
IMP	IMPERIAL
INSU	INSULINE
IRC	INT. RESISTOR CORP.
IREC	INT. RECTIFIER CORP.
IS	INSULATION SUPPLY
ITE	ITE CIRCUIT BREAKER
J	JOHNSON
JAN	JAN HARDWARE MFG.
JE	JEFFERSON
JEN	JENSEN
K	KIERLUFF
KENR	KEINER
KH	KRON-HITE
KING	KING
KT	KOOLTRONIC
KU	KULKA
KZ	KURZ-KASCH
LA	LYNCH ASBESTOS
LAMB	LAMBDA
LAR	L. A. RESISTOR
LE	LEACH
LER	LERCO
LI	LITTLE FUSE
LING	LING ELECTRONICS DIV.
LMB	LMB
LP	LAPP
LPD	LA-DEAU PROD.
LUNK	LUNKENHEIMER
M	MILLEN
MA	MALLORY
MD	MICRODOT
ME	METTSCRAFT
MEC	MEC
MH	MINNEAPOLIS HONEYWELL
MICA	MICAMOLD
MIN	MINARIK
ML	MACHLETT
MLR.	MILLER CO.
MMN	MARMON
MN	MARION
MOD	MODULONICS
MON	MONITOR
MOSE	MOSELEY
MOSS	MOSSMAN
MRC	MARCO
MRY	MURRAY
MS	MICROSWITCH
MTRO	MOTOROLA
N	NATIONAL CO.
NC	NATIONAL WIRE & CABLE
NE	NETWORK MFG.
NEI	NATIONAL ELECTRONICS INC.
NEP	NATIONAL ELECTRICAL PROD.
NHBB	NEW HAMPSHIRE BALL BEARING
NIBCO	NORTHERN INDIANA BRASS
NL	NATIONAL LOCK
O	OHMITE
OZ	O.Z. ELECTRICAL MFG CO.
PAN	PANDUIT
PANX	PANDUX
PCA	PCA
PE	PEERLESS
PENN	PENN CONTROL
PER	PERMOID
PH	PHILLIPS CONTROL (PHILTROL)
PHIL	PHILBRICK RESEARCH
PREM.	PREMIER METAL PROD.
PRKR	PARKER ELECTRICAL INST.
PRYN	PRYNE
PTB	POTTER - BRUMFIELD
PY	PYRAMID
QE	QUALITY ELECTRIC
R	ROTRON
RAY	RAYTHEON
RBC	RUBBERCRAFT
RCA	RADIO CORP. OF AMER.
RCC	RADIO CONDENSER CO.
RDL	RADIO DEVELOPMENT LAB
RE	REPUBLIC GLASS
REN	RENBRANDT
ROB	ROBERTSHAW-FULTON CON.
ROME	ROME
RT	RATIGAN
RY	RYTRON
S	SIMPSON
SA	SANGAMO
SAR	SARAN
SE	SERVICE
SEL	SELCO
SEP	STANDARD ELECT. PROD.
SH	SHALL CROSS
SI	SIGMA
SIE	SOUTHWESTERN IND. ENG.
SKT	SARKES TARZIAN
SK	SPENCER-KENNEDY-LABS.
SM	STANLEY MORRIS
SMC	SPECIALTIES MFG.
SMI	SMITH HERMAN
SOLA	SOLA ELECTRIC
SOR	SORENSON
SP	SPRAGUE
SPR	SUPREME
SQ	SQUARE D
SR	SIERRA ELECT. CORP.
SREC	STANDARD RECTIFIER
SS	SPECTRA-STRIP
STAH	STAHLIN BROS.
STAN	STANTRON
STIM	STIMSON, E.B.
STW	STANDARD WIRE & CABLE
SU	SUPERIOR ELECTRIC
SUPT	SUPRENANT
SW	SWITCHCRAFT
SW-CT	SWITCHING CONTROL
SWGL	SWAGELOCK
SY	SYLVANIA
T	TRIAD
T & B	T & B (CONNECTORS)
TH	THERMADOR
TI	TEXAS INSTRUMENT
TIC	TECHNOLOGY INST. CORP.
TNG	TUNGSOL
TR	TRUMBEL
TRAN	TRANSELECTRONICS
TRE	TRERICE
TRIM	TRIMM
TRID	TRID LABS. INC.
TX	TEKTRONIX
UI	UNISTRUT
ULAN	ULANET CO., GEO.
UN	UNIMAX
USDC	U. S. ELECT. DEVEL.
USEC	U. S. ENG. CO.
USG	U. S. GAUGE
UTAH	UTAH
UTC	UNITED TRANSFORMER
VAL	VALOR INSTRUMENTS INC.
WA	WALSCO
WAFD	WAKEFIELD ENGR.
WAT	WATERS
WB	WARNER BRAKE
WC	WEST COAST (WESCO)
WE	WESTINGHOUSE
WEL	WELWYN
WES	WESTON
WH	WAHLGREN
WHD	WEATHERHEAD
WHIT	WHITLOCK
WIN	WINCHESTER
WK	WECKESSER
WL	WARD LEONARD
WP	WESTCAP
WRMD	WIRE MOULD
WRNE	WESTERN ELECTRIC
WSPT	WESTPORT
WYCO	WYCO METAL PROD.
YO	YOUNG RADIATOR

ENGINEERING DRAWINGS

VN-330 SCHEMATIC 21776

MP MASTER
MA34249